

What is claimed is:

1. A regenerative optical amplifier, comprising:
  - a resonator for amplifying injected light;
  - a first polarizing portion for changing a direction of polarization of the input light, the direction of polarization of the input light being changed to a direction of polarization for injection to said resonator when the input light is supplied, continuing to drive said resonator with respect to the injected reciprocating light by application of voltage, and making the direction of polarization of light after completing a roundtrip the same as the direction of polarization of light prior to the roundtrip; and
  - a second polarizing portion driven by application of voltage to change a direction of polarization of amplified light amplified by said resonator, being initially driven by application of voltage when extracting the amplified light from said resonator, and changing the direction of polarization of the amplified light to a direction of polarization for extraction from said resonator.
2. A regenerative optical amplifier in accordance with claim 1, wherein said first polarizing portion is driven by application of voltage, such as to be driven by application of voltage when supplied said input light, changing the direction of polarization of said input light to a direction of polarization for injection into said resonator, continuing to be driven with respect to reciprocating light injected into said resonator, and changing a direction of polarization of light after completing a roundtrip to the direction of polarization of the light before making the roundtrip.

3. A regenerative optical amplifier in accordance with claim 2, wherein said first polarizing portion is provided on the roundtrip path of light in said resonator, and is driven by a voltage such as to rotate the polarization of transmitted light by 90 degrees, such that when said input light is supplied, voltage is applied to drive said first polarizing portion from the time said input light passes through said first polarizing portion on one of said roundtrip paths until the time it passes through said first polarizing portion on the other said roundtrip path.

4. A regenerative optical amplifier in accordance with claim 1, wherein said first polarizing portion changes the polarization of said input light to a polarization for injection to said resonator when no voltage is applied, and changes the polarization of light which has completed a roundtrip to the polarization of the light prior to the roundtrip when voltage is applied, such that voltage is applied after the polarization of the input light is changed to the polarization for injection into said resonator, and voltage is continually applied with respect to light which has been injected into and is reciprocating in said resonator.

5. A regenerative optical amplifier in accordance with claim 4, wherein said first polarizing portion comprises first and second polarizing elements provided on a roundtrip path of light in said resonator; the first polarizing element being a polarizing element for always rotating the polarization of light by 90 degrees with each roundtrip, and the second polarizing element being a polarizing element driven by application of voltage causing a 45-degree rotation in the polarization of light passed by said second polarizing element; said second polarizing element being driven by application of voltage, upon supply of said

input light, in the time between the first roundtrip of said second polarizing element made by said input light until the next roundtrip.

6. A regenerative optical amplifier in accordance with claim 4, wherein said first polarizing portion is provided on the roundtrip path of light in said resonator, rotates the polarization of light by 90 degrees with each roundtrip when no voltage is applied, and rotates the polarization of light by 180 degrees with each roundtrip when a voltage sufficient to rotate the polarization of transmitted light by 45 degrees is applied; said first polarizing portion being driven by application of voltage, upon supply of said input light, in the time between the first roundtrip of said first polarizing portion made by said input light until the next roundtrip.

7. A regenerative optical amplifier in accordance with claim 3, wherein said second polarizing portion is provided on the roundtrip path of light in said resonator, and is driven by a voltage such as to rotate the polarization of transmitted light by 90 degrees, such that when said amplified light is to be extracted from said resonator, voltage is applied to drive said second polarizing portion from the time said amplified light passes through said second polarizing portion on one of said roundtrip paths until the time it passes through said second polarizing portion on the other said roundtrip path.

8. A regenerative optical amplifier in accordance with claim 3, wherein said second polarizing portion is provided on the roundtrip path of light in said resonator, and is driven by a voltage such as to rotate the polarization of transmitted light by 45 degrees, such that when said amplified light is to be extracted from said resonator, voltage is

applied in the time from one roundtrip of said amplified light until the next roundtrip.

9. A regenerative optical amplifier in accordance with claim 1, wherein light reflected by a first polarizer for receiving light from outside said resonator is supplied to said first polarizing portion as input light.

10. A regenerative optical amplifier in accordance with claim 1, wherein said second polarizing portion changes the polarization of amplified light amplified by said resonator to a polarization of light reflected by a second polarizer receiving light inside said resonator.

11. A regenerative optical amplifier comprising:  
a resonator having first and second reflective mirrors forming ends of a roundtrip path for light, and an amplifying portion for amplifying light in said roundtrip path;  
first and second Pockels cells respectively provided on first and second reflective mirror sides; and  
first and second polarizers respectively provided between said first and second Pockels cells and said amplifying portion; wherein  
said first polarizer reflects light of a first polarization toward said first Pockels cell;  
said first Pockels cell is driven by application of voltage sufficient to rotate the polarization of transmitted light by 90 degrees in the time from when said light of a first polarization has passed through until it returns via said first reflective mirror, so as to convert light of said first polarization into light of a second polarization, said applied

voltage being maintained for a predetermined period so as to rotate the polarization of transmitted light by 90 degrees; and

said second Pockels cell is driven by application of voltage when extracting amplified light amplified by making a roundtrip of said amplifying portion from said resonator, so as to convert said amplified light to amplified light of said first polarization;

the amplified light of said first polarization being reflected by said second polarizer to be extracted outside of said resonator.

12. A regenerative optical amplifier comprising:

a resonator having first and second reflective mirrors forming ends of a roundtrip path for light, and an amplifying portion for amplifying light in said roundtrip path;

first and second Pockels cells respectively provided on first and second reflective mirror sides;

first and second polarizers respectively provided between said first and second Pockels cells and said amplifying portion; and

a waveplate provided between said first Pockels cell and said first reflective mirror, for rotating the polarization of light by 90 degrees with each roundtrip; wherein

said first polarizer reflects light of a first polarization toward said first Pockels cell;

said first Pockels cell is driven by application of voltage sufficient to rotate the polarization of transmitted light by 45 degrees in the time from when said light of a first polarization has been reflected at said first reflective mirror and completed one roundtrip of said first Pockels cell and said waveplate, been converted to light of a second polarization and completed a roundtrip of said amplifying portion side until it returns to

said first Pockels cell, so as to convert light of said first polarization into light of a second polarization, said applied voltage being maintained for a predetermined period so as to rotate the polarization of transmitted light by 45 degrees; and

said second Pockels cell is driven by application of voltage when extracting amplified light amplified by making a roundtrip of said amplifying portion from said resonator, so as to convert said amplified light to amplified light of said first polarization;

the amplified light of said first polarization being reflected by said second polarizer to be extracted outside of said resonator.

13. A regenerative optical amplifier comprising:

a resonator having first and second reflective mirrors forming ends of a roundtrip path for light, and an amplifying portion for amplifying light in said roundtrip path;

a first Pockels cell provided on said first reflective mirror side, whose optical axis is tilted in a direction such as to rotate the polarization of light by 45 degrees with each roundtrip;

a second Pockels cell provided on the second mirror side; and

first and second polarizers respectively provided between said first and second Pockels cells and said amplifying portion; wherein

said first polarizer reflects light of a first polarization toward said first Pockels cell;

said first Pockels cell is driven by application of voltage sufficient to rotate the polarization of transmitted light by 45 degrees in the time from when said light of a first polarization has been reflected at said first reflective mirror and completed one roundtrip of said first Pockels cell and said waveplate, been converted to light of a second

polarization and completed a roundtrip of said amplifying portion side until it returns to said first Pockels cell, so as to convert light of said first polarization into light of a second polarization, said applied voltage being maintained for a predetermined period so as to rotate the polarization of transmitted light by 180 degrees; and

said second Pockels cell is driven by application of voltage when extracting amplified light amplified by making a roundtrip of said amplifying portion from said resonator, so as to convert said amplified light to amplified light of said first polarization;

the amplified light of said first polarization being reflected by said second polarizer to be extracted outside of said resonator.

14. A regenerative optical amplifier in accordance with claim 11, wherein said second Pockels cell is driven by application of a voltage sufficient to rotate the polarization of transmitted light by 90 degrees in the time from when said amplified light has passed until it returns via said second reflective mirror so as to convert said amplified light into amplified light of said first polarization.

15. A regenerative optical amplifier in accordance with claim 11, wherein said second Pockels cell is driven by application of a voltage sufficient to rotate to polarization of transmitted light by 45 degrees from the time when light which has made a roundtrip of said amplifying portion to become said amplified light has completed a roundtrip until prior to said amplified light passing through so as to convert said amplified light into amplified light of said first polarization.